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"FAT IN INFANT DIETETICS."

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FAT IN INFANT DIETETICS.

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Since Biedert's monograph in 1869, on "Investigations concerning the difference between Human Milk and Cow's Milk," the question of artificial feeding of infants, from the point of view of the harmfulness or otherwise of the various constituents of milk has passed through many phases.

At first, the central idea was the indigestibility of the casein of cow's milk, and attempts at artificial feeding were based on this. Following the work of Escherich 1886 concerning the bacterial changes in the infants intestine, with particular reference to fermentation and putrefaction, came the work of Czerny.

He suggested the term "Disturbances of Nutrition" instead of "gastro-intestinal diseases" and followed carefully the etiologic influence of the various food elements in causing these disturbances.

In Czerny and Keller's text book on infant nutrition, they divided nutritional disturbances into three broad groups (1) from food, (2) from infection, (3) from constitution.

In the first group came (1) fat injury, (2) starch injury,

(3) /

(3) gelatin injury, (4) scurvy. The most important of all food injuries they consider fat injury (Fettnährschaden).

Czerny also attacked the old supposition that protein was the most important cause of digestive troubles. He says "There is no single symptom which can show us injury to the infant through protein ..... In overfeeding with milk, a fat injury and not a protein occurs."

About 1907, the teachings of Finkelstein and Meigs began to come into prominence. They taught that the salts of whey and the sugar were the harmful constituents in cow's milk - the whey salts depress the antibacterial function of cells of the small intestine and thus allow too profuse bacterial growth and consequent fermentation of sugar.

Summed up, Finkelstein taught that protein never does any harm, fat is only harmful where there is primary sugar injury and sugar is the one particular thing that causes trouble in babies. Thus in turn, every food element has been considered the chief offender in disturbances of Nutrition in infants.

After seeing the result of over-feeding with fat on a large scale, one cannot but feel that this element holds an important place in the troubles which beset the artificial feeding of infants.

More especially is this the case when mothers come to look on the weight chart as the absolute guide as to the well /

well-being or otherwise of their babies. With most mothers, the fatter and heavier their offspring the better they are pleased, and an infant grossly overweight becomes an object of maternal pride.

The basis of this paper is on work done on infant feeding in New Zealand. There, practically the whole of infant feeding is supervised by a Government subsidised society called the "Plunket Society", after Lady Plunket, wife of one of the Governors who took much interest in Infant Welfare. Briefly, the Society has "clinics" in every town, run by nurses - "Plunket Nurses" who have had training at one of the Society's Homes.

There is no medical supervision of these clinics whatever, the nurses run them themselves, and the method of feeding is according to a hard and fast rule and is the same throughout the country.

The formula used is founded on the work of Rotch in America some thirty years ago - the so-called "humanised" or percentage-milk, and is made up as follows: a portion of the milk is set aside to allow the cream to rise. The remainder is warmed, curdled with rennet and the resultant whey added to the day's milk which is drawn off from the top sample and sugar and lime water added.

As large areas of New Zealand are devoted to dairying and the ideal for butter making is a milk with a high fat content, many /

many herds are either entirely Jersey Cows or have a percentage of Jersey or Jersey strain cows in them.

As the fat content of Jersey milk is between 5 and 6% as compared with an average of 3% in average herd milk, this is an important factor.

Comparison of Fat of Human and Cow's Milk.

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The fat in human milk is the most variable of its constituents, and the quantity varies considerably according to the portion of a feed which is examined.

At the beginning of a nursing it may be as low as 0.66% and as high as 10% in the last part. (Dennis & Talbot, American Journal Diseases of Children. Vol. 18 No. 2 1919).

There is usually, however, less than 4% of difference according to their table.

The average fat composition of human milk is between 3 and 5% according to Holt.

The fat of human milk is made up chiefly of the neutral fats, palmitin, myristin, stearin and olein, the last mentioned predominating. There are also small quantities of free fatty acids, though less than in Cows milk. The fat in human milk is low in volatile fatty acids - Levine (Archives of Pediatrics June 1926) gives the following fugures in comparing the fatty acid content with that of cows milk.

Human 2.5% of total fat.

Cow's 27%.

This difference in the composition of the two fats is probably at the root of the trouble met with in cases of fat intolerance in Cow's milk feeds.

Cows/

Cows Milk.

Cows milk contains fat to the extent of 3 to 4%, from an average herd. Milk from Jersey Cows contains between 5 and 6% fat.

The globules in butter fat are larger than in human milk, but the most important difference is the volatile fatty acid content which is ten times greater in cows milk. Holt states that this difference is the cause of the indigestibility of cow's fat and has much to do with the development of fat intolerance in artificially fed babies. Weston (Archives of Pediatrics Nov. 1926) states that the butter fat from different breeds of cows differ in digestibility on account of the difference in size of fat globules and in the volatile fatty acid content. He considers that the latter also is higher in Jerseys. The tolerance for cow's fat differs in children, some being unable to take the smallest percentage without gastro-intestinal upset.

It is not safe to exceed 3.5% in any infant under one year of age (Holt).

Metabolism of Fat.

Fat, as it exists in milk is in the form of neutral fat, a combination of glycerin and higher fatty acids.

During/

During digestion, the neutral fat is split into these two component parts. Most of the fat digestion takes place in the upper portion of the small intestine where the steapsin of the pancreatic juice splits it into glycerin and fatty acids, the latter combine with the alkalies in the intestine to form soaps which are emulsified and made soluble by a combination with the bile and then absorbed. The soaps are resynthesised during the passage through the intestinal wall into neutral fats.

The soaps formed are largely of the higher fatty acids, palmitic, stearic and oleic; the calcium soaps, especially that of palmitic acid are relatively insoluble.

According to Bosworth, Bowditch and Giblin (American Journal of Children's Diseases, Vol. 15 No.6, 1918) 100 grammes of butter fat when saponified yield 38% of palmitic acid, the calcium soaps of which are relatively insoluble.

When the fat of human milk is saponified less palmitic and more oleic acid is produced.

In discussing fat metabolism, the question of soap stools may be taken up.

According to Howland (American Journal of Children's Diseases, Vol. V. 1913) these occur when these conditions are present in the food.

(1) a large amount of fat.

(2) a large amount of calcium and casein

(3) a lack of carbohydrate.

The /

The presence of the above conditions in the intestines leads to an alkaline condition with slowing of peristalsis, this favours the formation of insoluble calcium soaps, fat absorption becomes poor and there is a small retention of calcium and magnesium. The question of poor calcium retention is perhaps the most important from a nutritional point of view, as cases with soap stools are more prone to develop spasmophilia. It will be noticed that the question of carbohydrate metabolism is intimately bound up with that of fat, and that in certain cases a very high fat can be fed if there is sufficient carbohydrate present, as for example in Schick's concentrated feeds - whole milk undiluted with 17% added carbohydrate.

The ultimate fate of fat not absorbed may now be considered.

In the stools it exists as (1) neutral fat which has not been acted on by the digestive juices (2) fatty acids, representing fat which has been split and (3) soap which has been both split and saponified.

Most of the fat present is saponified, especially if the intestinal reaction is alkaline.

If the reaction is acid the fatty acids increase. Thus the effect of fat depends on the reaction of the intestine, which in turn depends on the relative proportions of sugar and protein.

Digestive /

Digestive Troubles.

As has been pointed out, the fat content of human milk varies considerably, and as has been mentioned may be as high as 10%. On account of its finer globules and lower fatty acid content, an infant can tolerate a much higher percentage than of butter fat, but sometimes serious gastro-intestinal upset may follow the ingestion of too high a percentage.

Some infants have a lowered fat tolerance and quite small amounts of human fat may cause trouble - as Still puts it "the baby does not agree with the milk". Where the fat tolerance of an infant is being exceeded with human milk there is usually vomiting or diarrhoea or both. The intestinal symptoms are due to the low casein content combined with high fat and high carbohydrate.

Treatment consists, not in immediately weaning the child - if this is done there is the prospect of worse trouble - but in attempting to adjust the mother's milk to the infants capabilities, either by

(1) Reducing the fat intake by shortening the feeding periods so as to avoid the "strippings" or

(2) by giving more calcium and casein with the object of forming calcium soaps.

This can be done by feeding one to two tablespoonfuls of/

of boiled skimmed milk after each breast feed.

It is not so much in breast feeding that there is trouble with fat tolerance as in artificial feeding which will be next considered.

At the present day the majority of infants who require artificial feeding are fed on a cow's milk mixture of some description.

The average infant will do well on any moderately sensible whole milk dilution with added carbohydrate. A certain proportion will require their feedings carefully regulated, and this proportion will increase considerably if a top milk formula or one containing Jersey milk is used.

In connection with Jersey milk, a word may be said in passing about Certified Milk. While undoubtedly a tremendous advance in infant feeding, one sometimes comes across children who do not do well on it. They are generally children with a low fat tolerance.

As it is well known, one of the standards of Certified milk is a butter fat content of at least 3.5%. Many Certified herds give a milk much exceeding this, mainly on account of the inclusion of Jersey Cows whose butter fat value is extremely high. This, one thinks often leads to the milk being too rich in fat for infant feeding, especially for children with a low tolerance, more particularly as the fat of Jersey milk is said to contain a bigger percentage of the volatile fatty acids than milk from an ordinary shorthorn herd.

Symptoms of Overfeeding with Fat or Fat Intolerance.

Acute Fat Indigestion.

This is most commonly seen in infants under two or three months of age, and consists of vomiting of sour thick creamy material and passage of loose greenish stools, usually acid in smell and reaction.

The number of stools may vary from three to six or more and usually cause excoriation of the buttocks.

The gastric disturbance is probably caused by irritating free fatty acids, the diarrhoea by the irritant action of the unabsorbed fat on the intestinal mucosa and also probably by a certain amount of bacterial decomposition of fat.

The fat in the stools is usually in the form of fatty acids or soap, but in some cases where there has been much excess, the stools may be loaded with neutral fat.

Cases of this type are most commonly seen where a top-milk mixture has been used or where a milk with too high a fat percentage, such as Jersey, or both.

Treatment consists essentially of feeding a fat free diet until the gastro-intestinal condition has improved and then proceeding very carefully with the addition of fat, taking care not to exceed the limit of tolerance.

It is best to stop all food for at least eight hours, except water, and then to continue with either a boiled skimmed/

skimmed milk feed, or alternatively Protein milk or one of its modifications, e.g. addition of powdered casein.

Chronic Fat Indigestion.

This is one of the commonest types of chronic indigestion in infants and may result from (1) fat alone (2) from fat not in itself in excess but given with a badly balanced feed or (3) from bacterial action on undigested fat.

What fat is going to do in any given intestine depends largely on the reaction of the intestinal contents and the rate of perestalsis.

If perestalsis is slow and the reaction alkaline, calcium soap formation takes place with constipation. If fermentative bacteria are acting on the fat, in other words if the reaction is acid, the stools are loose, acid and curded. If a high fat is fed with a high protein the first picture results, if with a high sugar and a low protein the second picture may occur.

In dealing with fat indigestion the examination of the stools is of the utmost importance but to be of value it must be considered in conjunction with other data, as gain in weight, general condition and type of food being fed.

The commonest type of feeding trouble in artificially fed babies is the first type - the constipated type.. As has been mentioned it is usually due to a feed having too high /

high a fat and protein content with too low a sugar percentage.

The results of protein digestion are alkaline and the proportion of calcium in cow's milk tends to make it more so, and if in addition there is a low sugar intake what sugar there is is totally absorbed, leaving none to support the normal fermentative acid-producing bacteria of the intestine.

The higher fatty acids in such conditions of slow peristalsis combine with the abundant calcium present to form calcium soaps, these cannot be absorbed and form the hard dry light-coloured stools. Thus the infant not only loses a good deal of nutriment on account of the low fat absorption but also loses a good deal of calcium too.

The above condition is usually seen in infants over six months and is often accompanied by a lack of gain in weight. This often leads to the infant being fed still more fat, either as cream or one of the proprietary fat foods with further aggravation of the condition.

There are some children who however continue to gain in weight, becoming fat, pale and lethargic, till at the end of the first year they may weigh thirty or more pounds. Such children are often looked on with pride by parents, but unfortunately such advancement in weight does not continue.

One repeatedly saw in New Zealand, for example, where excess of fat feeding is almost routine, numbers of children at about three or four years of age, almost in a state of "malnutrition". The history of the mothers was invariably the /

the same - the child was fed on top-milk from birth, was constipated most of the first year, but gained in weight rapidly, till at the end of the first year the weight was eight to ten pounds above the average. After that they began to fail, became pale and flabby and thin, went off their food and suffered more or less from chronic indigestion.

As a rule, in an attempt to improve the condition, cod liver oil, cream etc. were forced, with, if anything, worse results. One found these children extraordinarily intolerant of fat in any form, and amongst many of them there developed cyclical vomiting as they grew older.

By means of a carefully regulated diet mainly of proteins and carbohydrates, most of these children improved, but fat had to be given in very judicious quantities. Of course, one sees many children about the age of four years who clearly resemble the above picture, but one could not but be struck by the similarity in the histories of many of such cases, particularly in relation to the amount of fat given in the first year.

School doctors in New Zealand have also noted the increase in what appear to be cases of "malnutrition" in the last few years, and as the crop of "Plunket babies" are now of school age that is rather a significant fact, especially as poverty and poor feeding as are seen in the poorer districts of this country are unknown there.

Many of the worst cases of "malnutrition" in the schools - those/

those that are picked out for sending to "Health Camps" are from excellent homes.

Treatment.

The essential in treatment is to change the putrefactive process in the intestine to mild fermentation. This is best accomplished by feeding a mixture lower in protein and fat and higher in carbohydrate.

The increase in carbohydrate serves a double purpose - it tends to increase the acidity of the intestinal contents and also to supply additional calories. Lactose is the most efficient sugar from an acid producing point of view, but by utilizing two or more sugars with different rates of absorption e.g. dextri-maltose and lactose or cane sugar, a food of higher value can be fed.

It is seldom necessary in these cases to eliminate fat entirely, but milk should be partially skimmed; except in some cases where a completely skimmed milk is necessary. Fat will need to be added very cautiously as the tolerance of these babies is easily exceeded.

The Second Type of Chronic Fat Indigestion.

In this type there has usually been either a gross overfeeding with fat, or inability to digest normal amount of fat. The stools are usually loose in character, of a yellowish or yellowish/

yellowish-green colour, acid in reaction and containing fat curd . They may vary from three to six a day, and excoriation of the buttocks often takes place. Vomiting is common, and the stools contain a quantity of neutral fat. There is often some carbohydrate intolerance in addition.

Babies suffering from this type, rapidly lose strength, appetitie and weight and may become marasmic. In fact in the majority of marasmic babies fat intolerance in some form is at the bottom of their trouble.

Treatment.

The treatment of this type requires to be much more drastic, and the complete withdrawal of fat from the diet is usually necessary.

The protein should be raised, but carbohydrate has to be used sparingly on account of the often associated poor sugar tolerance and the acid condition of the intestine.

In a severe case it may be necessary to use protein milk, or at any rate a skimmed milk preparation. At the best, progress will be slow in this type, and any excess will lead to gastro-intestinal upset.

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Much ingenuity has been expended in attempting to find a feed suitable to these more or less marasmic children with marked fat intolerance. One of the most ingenious, and at the /

the same time useful, is the Butter-flour Mixture of Czerny and Kleinsmidt. It is an attempt to approximate the fat composition of human milk, with the irritating fatty acids of butter fat removed, and the carbohydrate in a slowly fermentable form.

In many cases of fat intolerance it enables fat to be fed to an infant without upset. It is made as follows:-

Butter	20 grammes
Flour	20 grammes
Sugar	15 grammes
Water	300 c.C.

The butter is slowly heated in a pan over a gentle fire until foaming takes place and until any odour of volatile fatty acids has disappeared - three to five minutes. With this is mixed the flour and the mixture gently boiled four or five minutes until of a brownish colour. Finally 300 c.c. of warm water and 15 grammes of cane sugar are added and the combination again boiled and rubbed through a fine sieve to remove lumps and then mixed with the desired amount of previously boiled cooled skimmed milk.

For children under 3000 grammes in weight one-third milk is mixed with two-thirds butter-flour mixture, for children over 3000 grammes two-fifths milk to three-fifths of the stock is given. Not more than three ounces per pound of body weight should be given daily. Usually smaller amounts are required. (Crozier Griffith, Therapeutic Gazette, Nov. 15, 1921.)

In a comparison on a caloric basis of the various milk mixtures /

mixtures used in infant feeding, Powers (American Journal of Children's Diseases Oct. 1925) states that "The Czerny-Kleinsmidt Butter-flour mixture has essentially the percentage caloric apportionment to protein, carbohydrate and fat of human milk."

In any case it is a useful food for supplying fat to an infant who cannot manage it in the ordinary form, mainly due to the expulsion of the irritating fatty acids.. It is probably on account of this expulsion of volatile fatty acids that dried milk preparations, such as "Glaxo", sometimes succeed when an ordinary milk mixture fails.

The "drying" of the milk is done by running it over hot cylinders, or, as is done with the Merrell-Soule method by blowing the milk in a fine spray across a blast of hot air, the resultant powder falling to the floor. The hot roller method seems to give the best results.

Another method of feeding in cases of fat intolerance is with Finkelstein's Protein milk or one of its modifications, such as skimmed milk with added casein. This makes a completely fat-free milk and has a higher caloric value than plain skimmed milk. In the diarrhoeal cases it is especially useful in the early stages, and the carbohydrates can be raised considerably with it without causing any upset.

Lactic acid milk is also of use in cases of fat intolerance. First introduced by Marriott for cases of marasmus and prematurity /

prematurity it was found to be extremely useful in cases of dyspepsia.

Much higher percentages of both fat and carbohydrate can be taken if the milk is acidified, probably because the protein is also fairly high - it is essentially a concentrated feed. In addition to lactic acid, citric acid, hydrochloric acid, and acetic acid have been used with good results.

Still another method is the thick cereal feed introduced by Sauer in 1918 for the treatment of pyloric stenosis but since used in cases of malnutrition and fat intolerance. It may be made up either with water or skimmed milk as follows:-

Skimmed milk 30 ounces
Cereal (Rice flour) 8 tablespoonfuls.

Boiled down till it sticks to an inverted spoon. It is also a concentrated feed of a high caloric value, which may be raised still more by the addition of sugars-dextrimaltose

Further attempts have been made to produce a fat similar to the fat of human milk, such as homogenised olive oil and "S.M.A." - synthetic milk adapted. This latter was prepared by Gerstenberger (American Journal of Children's Diseases, Vol. 10, 1915.

It was an attempt to approach the fat of human milk chemically - the same volatile fatty acid content and milking point. It consists of tallow oil, cocoanut oil, cocoa butter, cod liver oil and tallow. Good results are reported from the United States where it has a considerable sale.

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In New Zealand there was also an attempt to make a fat mixture for children's use, consisting of various oils including cod liver and peanut oil but it was not well tolerated by infants, particularly those who were already suffering from fat injury.

Next come the malt soups. These were introduced by Keller in 1898 and were often useful in chronic fat indigestion. They contain a low fat and high carbohydrate percentage, the latter being present in four different forms, lactose, ~~maltose~~ maltose, dextrine and starch.

In using this, as in any other artificial feed, care has to be taken to supply sufficient anti-rachitic factor, either as cod liver oil or ultra-violet light or both.

The vast majority of proprietary artificial foods consist mainly of carbohydrate which accounts for much of their success in babies which have had fat indigestion and whose mothers have tired of using cow's milk mixtures and have turned to some advertised baby food.

Influence of Fat on Some Maladies of Infancy and Childhood.

In New Zealand, one noticed a very high percentage of cases of infantile eczema, generally appearing about the third month. The children were usually grossly over-weight and had been fed on a rich top-milk feed. Many cases were seen where the milk had been obtained from the best Jersey cow in the herd, which was reserved for the household use. There was no family history of eczema or asthma in most cases and they were remarkably intractable to external applications.

A cure, or considerable improvement could be brought about within a few days by putting them on a fat-free diet, or on one with a low fat content. A return to Jersey milk or a top milk mixture almost invariably led to a recurrence of the condition. The immediate results from cutting down the fat intake seemed to point to the cause of the condition, although at the same time, one must bear in mind the large amount of literature that has accumulated with regard to protein sensitisation as the cause of infantile eczema.

Unfortunately one could not obtain the necessary reagents abroad for doing a series of tests on those lines, but results from using them appear to be confusing. Cooper (American Journal of Diseases of Children, March 1925) mentions that the "presence of a positive cutaneous test is not /

not a criterion to the successful treatment of infantile eczema.

One's attention was drawn to the question as to whether fat, per se, was the cause of the condition or whether it was the form of fat taken. From results obtained with the Czerny-Kleinemidt Butter-flour mixture, it appeared that the volatile fatty acid content of the fat had something to do with it. Again where the milk was subject to prolonged boiling, improvement was noticed in several cases.

Below are some illustrative cases.

J. T. H. aged 4 months, fourth child. Nothing of note in family history. No eczema in previous children who are all well. Birth weight 7 lbs. Present weight 15 lbs. Breast fed for 3 weeks, then weaned on to a top-milk feed - Jersey milk. Plump, flabby baby, somewhat constipated. Eczematous rash over cheeks and forehead for the past month.

Put on to a simple dilution with half the cream removed from the milk. In four days the rash disappeared.

D. T. 4½ months. Second child. First died from Bright's Disease. Easy labour, 9 lbs. at birth. Breast fed for three months when milk dried up. From then a top-milk mixture was used. The baby became constipated, and in fourteen days a rash appeared on the face and in the flexures behind knees. Weight at this time 17 lbs. Fat and flabby.

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A skimmed milk mixture was prescribed, and in a few days the rash disappeared. A change was made to a whole milk dilution but the skin condition returned. A Butter_flour mixture was then tried with complete success.

A. S. 7¼ lbs. at birth. Weaned at five weeks on to a top milk mixture. In a week constipation and eczema of face developed. The cow from which the milk was obtained in this case tested out at slightly over 5 % fat.

A whole milk mixture with half the cream removed was prescribed and in a few days the condition cleared up.

In addition, one has noticed a tendency to eczema in several children in this country who have been fed on certified milk, and generally the condition has cleared up on feeding milk partially skimmed or reverting to ordinary milk which has been scalded.

This brings up the question of certified milk for infant feeding. While in the matter of cleanliness in handling and freedom from tubercle bacilli it is a tremendous advance in infant feeding, one wonders whether it would not be of advantage to place some limit on the fat percentage of milk primarily produced for infants.

At present all certified milk must contain at least 3.5 % of fat. For the average child this is quite sufficient and for a child with low fat tolerance, too much, especially as /

as the herds often contain many Jerseys whose fat seems curiously unsuitable for infants.

Many mothers nowadays order certified milk for infant feeding and if the child does not thrive on it, they usually fly to some proprietary food under the impression that if certified milk - the best obtainable, does not suit, then no form of cow's milk feeding will be of value.

In producing a milk that is essentially for the feeding of young children, this point is apt to be over-looked and one feels that better results would be obtained if farmers concentrated on the hygienic side of milk production and paid less attention to producing a milk that will test out high in butter fat content.

While not asserting that all cases of infantile eczema are due to excessive amounts of fat, one cannot help feeling that in many cases there is some relation between the two - at any rate in the type of case which Czerny described as suffering from the exudative diathesis - in spite of the "foreign protein" theory which has held sway for the past few years.

In older children the evil effects of excessive fat feeding in infancy are seen in cases of cyclical vomiting and chronic fat indigestion. One noticed many cases of the former in New Zealand - a much larger percentage than is seen in this country. There was usually the same history /

history of rich top-milk feeding in infancy, a child grossly over-weight for the first two years and then fading away and becoming thin, pale, listless and extraordinarily intolerant of fat in every form - almost like coeliacdisease.

The mothers generally tried to improve the condition by supplementing the usual food with cod liver oil and some such "extra", thus setting up more or less of a vicious circle. Once these children had their diet adjusted and a comparitive increase in carbohydrates given, their condition improved, but slowly.

The intolerance for fat lasts many years in these children and one has put it down to the metabolic system becoming deranged by the excess of work put on it during the earlier months of life.

Another point which may be noted is that mothers, as the result of much propoganda, are in the main afraid of feeding children carbohydrates, in the form of sugar especially . The desire for sweet things seems natural in children, and when one considers the necessity for adequate carbohydrate to metabolise fat, the most difficult of the food elements for a child to handle, it seems that the desire should not be thwarted entirely.

If given in proper form and not in excess sweet things will often do nothing but good.

Osman of Guy's Hospital has applied the name "sugar shortage" /

shortage" to a condition often seen in children - pallor, listlessness, thinness and liability to attacks of cyclical vomiting, and treats it by increasing tremendously the sugar intake - jams, treacle, sugar, fruit juice, etc. at the same time cutting down the fat intake.

Chronic Fat Indigestion.

This has been referred to several times above, the most typical cases being seen in children between the ages of two and six years.

The symptoms are mainly those of malnutrition often accompanied by vomiting and intestinal symptoms, fretfulness and other nervous disorders.

The above type of child was seen regularly in New Zealand, generally from good homes and with the usual history of high fat feeding in infancy. At the end of the first year they were grossly over-weight - much to the parent's pride, and the mothers could not understand how their children had failed so in the last year or two.

Some of these children looked almost like cases of coeliac disease and with the intolerance of fat the picture was emphasised. The stools were often of the grey, greasy appearance seen in that disease.

Most of them improved if put on to a more or less fat free diet, but were liable to gastro-intestinal upsets for quite a time /

time until their metabolic system recovered.

It was children of this type who were labelled cases of "malnutrition" at school inspections and were sent to Health Camps during the Summer under officers of the school medical service.

A responsible officer of the above service was strongly of the opinion that such cases had increased tremendously among school children since the top-milk method of feeding had become almost universal among infants throughout the country.

Coeliac Disease.

Closely allied to the above condition is coeliac disease. The etiology of this condition is more or less obscure. In some cases it appears to be constitutional, in others the question of infection arises, as the condition often follows on a prolonged attack of diarrhoea. (It is likened by some authorities to sprue).

Many cases appear to be due to prolonged injudicious feeding in infancy, particularly with fat. (Holt & Howland. Diseases of Children". Hill "Infant Feeding" etc.) At any rate once the condition is established, avoidance of fat is the chief consideration in treatment, which has to be prolonged.

Hypertrophic Pyloric Stenosis.

Hypertrophic Pyloric Stenasis.

The etiology of this condition is obscure. Whether it is a simple development anomaly or is caused by some abnormal stimulation causing rhythmic contractions of the pylorus is as yet not settled.

Surgery is the method of treatment in favour just now, but the question of feeding in preparation for and after operation is of importance, also in these cases which are unsuitable for surgical interference.

Case of stenosis or pylorospasm do not tolerate fat at all, and the mainstay of medical treatment is the prescription of a diet containing as little of this element as possible.

Dilute skimmed milk mixtures, or one of the thick cereal feeds introduced by Sauer are the most useful. The latter should be made up with water or diluted skimmed milk, and are often worth a trial before resorting to operative interference.

SUMMARY.

One of the most important factors in the feeding of infants is the question of the quality and quantity of fat used. The most easily digested fat of all is that contained in human milk.

The fat of cow's milk is much more difficult for the infant to digest, mainly on account of its higher volatile fatty acid content. It is this factor rather than the higher protein content which is the cause of trouble in most artificially fed infants.

The fat of Jersey milk is much more difficult for an infant to metabolise than that from the average Shorthorn. No attempt should be made to feed as high a percentage of butter fat as is found in human milk.

Neglect of these precautions leads to various intestinal upsets in infancy, often to marasmus, and in older children the ill effects are often seen for a year or two in lessened fat intolerance, cyclical vomiting and chronic indigestion.

The evil effects of excessive fat feeding in infancy are commonly seen in New Zealand where top-milk feeding with rich milk is almost universal.

With the introduction of certified milk in this country there is a danger of the same thing happening if "richness" of the milk is made one of the ideals. Fat percentage in cow's /

cow's milk of from 3% to 3·5% is ample, in fact the latter figure is often too high for weakly babies.

Several methods of feeding have been introduced for dealing with infants whose fat tolerance is low either constitutionally or through wrongful feeding. These include skimmed milk mixtures, butter-flour mixtures, protein milk, S.M.A. lactic acid milk, thick cereal feeds, and "malt soup" mixtures. In most cases the skimmed milk mixtures are easier to prepare and give excellent results.

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